

- G. **Epoxy Paint Pavement Marking.** This item will be measured by the Linear Foot of the various widths of installed line, complete, in place, and accepted. Only marked portions of broken lines will be measured. Epoxy Paint Pavement Marking – Messages will be measured by the square footage shown on the plans, in place, and accepted by the Engineer.

## **762.06 BASIS OF PAYMENT.**

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Pavement Marking Painted - ____ inch line	Linear Foot
Pavement Marking Painted – Message	Square Foot
Plastic Pavement Marking Film - ____ inch line	Linear Foot
Plastic Pavement Marking Film – Message	Square Foot
Preformed Patterned Pavement Marking - ____ inch line	Linear Foot
Preformed Patterned Pavement Marking – Message	Square Foot
Pavement Marking Sheeting - ____ inch line	Linear Foot
Pavement Marking Sheeting – Message	Square Foot
Short Term – ____-Inch Line (Painted, Tape, or Raised Markers)	Linear Foot
Short Term – ____-Inch Line, Type R	Linear Foot
Short Term – ____-Inch Line, Type KNURL	Linear Foot
Short Term – Message, Type R	Square Foot
Short Term – Message, Type NR	Square Foot
Short Term – Painted Line (Seal Jobs)	Linear Foot
Raised Pavement Markers	Each
Obliteration of Pavement Marking	Square Foot
Preformed Patterned Pavmt. Marking – __ inch line (Grooved)	Linear Foot
Preformed Patterned Pavmt. Marking – Message (Grooved)	Square Foot
Preformed Plastic – ____-Inch Line	Linear Foot
Epoxy Paint Pavement Markings – ____ inch line	Linear Foot
Epoxy Paint Pavement Marking – Message	Square Foot

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

The price bid for Type R marking film shall include the cost of installation and removal.

## **SECTION 764 GUARDRAIL**

### **764.01 DESCRIPTION.**

This work consists of installing, removing, and resetting guardrail and box beam median barrier.

**764.02 MATERIALS.**

Materials shall meet the following:

<b>Item</b>	<b>Section</b>
Concrete, Class AE	802
Reinforcing Steel	836.02 A
Cable Guardrail, Wire Rope, and Fittings	862.02
W-Beam Guardrail, Guardrail Units, and Fittings	862.03
Treated Wood Guardrail Posts	862.04
Steel Guardrail Posts	862.05
Box Beam	862.06

**764.03 CONSTRUCTION REQUIREMENTS.**

- A. **General.** The guardrail shall be installed to produce a smooth continuous line with uniform height.

Guardrail posts shall be installed where staked and to the depth specified. Posts shall be set plumb with the front faces uniformly aligned.

Posts may be driven using a suitable head to prevent damage to the post. Damaged posts shall be replaced at the Contractor's expense. The post being replaced shall be installed by drilling. A post cap must be used when minor vertical adjustments are made using a sledgehammer or maul.

When posts are installed in augured or dug holes, the holes shall be backfilled with approved material and the surplus excavated material disposed of at locations acceptable to the Engineer. The backfill shall be placed and compacted in 8-inch layers, using a mechanical tamper with an appropriate sized tamping head without displacing the post alignment.

Drilling post holes in pavement shall be done without damage to the surrounding pavement. The proposed drilling method and equipment shall be approved by the Engineer before work is begun. Backfill shall be as described above except that the final 8 inches of backfill shall be bituminous material approved by the Engineer.

Underground utilities or structures shall not be damaged when installing posts or anchor units. Any damage to utilities or structures shall be repaired at the Contractor's expense according to Section 105.03.

Concrete pedestals shall be cast in place.

No burning or welding will be permitted in the field or after the material has been galvanized. Only drilling will be allowed on the work site.

Galvanized surface that has been damaged in transporting, handling, or erecting shall be repaired at the Contractor's expense. The damaged area shall be thoroughly cleaned by wire brushing and painted with 2 coats of matching zinc-rich paint.

All bolts and nuts, except adjustment bolts, shall be drawn tight. Bolts shall extend at least 1/4 inch but no more than one inch beyond the nuts.

Guardrail materials laid out along the shoulder at the work site and not installed by the end of the work day, shall be removed according to Section 107.05 A. Post end, beam, and end terminal sections shall be erected in a continuous operation within each individual run of guardrail and each individual run shall be completed the same day. Incomplete guardrail installation shall be marked by vertical panels, drums, and reflectorized plates at a 50-foot maximum spacing.

Reflectorized plates shall be new and shall be furnished and installed as shown in the Contract.

On projects where the roadway will be open to traffic during construction, delineator drums shall be installed at 25-foot intervals adjacent to the work site at each location where existing guardrail is removed, or where no guardrail previously existed, or at guardrail extensions. The delineator drums shall remain in place until the installation of the guardrail at that location is complete and accepted by the Engineer.

Parking of equipment and vehicles, and the storage of materials, shall meet Section 107.05 A.

At bridge connections, the attachment brackets shall be fabricated so the attachment bolt holes can be field drilled to fit the in-place bridge posts and rails. All rail shall be field drilled for connection to attachment brackets and furnished with necessary shims to meet alignment requirements.

**B. Cable Guardrail.** Cable guardrail shall be erected to obtain a smooth continuous taut rail.

All cable slack shall be eliminated by over-tensioning the cable as much as possible and then backing off to the required tension.

The rail will have reached the required tension when the cable will deflect no more than 5 inches in a 12 1/2-foot span under a central load of:

200 lbs. when the temperature is 100°F.  
 220 lbs. when the temperature is 80°F.  
 240 lbs. when the temperature is 60°F  
 260 lbs. when the temperature is 40°F

The tension shall be the same in all cables and throughout the length of the rail.

Intermediate anchors shall be spaced at intervals not to exceed 1,000 feet on tangents and outside of horizontal curves. Cable shall not be installed on the inside of curves sharper than 4°. On the inside of curves at 4° or flatter, intermediate anchors shall be spaced at intervals shown on the Standard Drawings.

Concrete bearing blocks may be precast or cast in place. Concrete anchors shall be cast in place and the earth surrounding the anchor shall not be disturbed.

At all locations where cable is connected to a cable socket with a wedge-type connection, one wire of the wire rope shall be crimped over the base of the wedge to hold it firmly in place.

- C. **W-Beam Guardrail.** The rail sections shall be joined so the splices are lapped to flow in the direction of the traffic nearest the guardrail. Plate ends in lap splices shall make contact throughout the entire area of the splice.

A manufacturer's representative shall be available, on an as need basis, for the installation of the guardrail end treatments. The Contractor shall furnish 3 copies of the installation instructions and drawings of the guardrail end terminals to the District Engineer. One copy is for the Project Engineer, 1 copy is for the District Engineer, and 1 copy is for the Traffic Control Engineer. The detailed drawings shall contain all components of the end treatment assembly.

- D. **Removal of Guardrail.** The undamaged guardrail, wood and steel posts not to be reset shall be removed and stockpiled within the Right of Way at designated locations, and shall become the property of the Department. Guardrail and posts designated for salvage or reuse that are damaged by the construction operations shall be replaced at the Contractor's expense.
1. **Cable Guardrail.** The salvage cable shall be in rolls for ease of handling.
  2. **W-Beam Guardrail.** Rail removed for reset shall be in lengths not to exceed 50 feet. Rail removed and not to be reset, shall be disassembled at each joint or splice.
  3. **Box Beam Guardrail.** Rail removed for reset shall be in lengths not to exceed 36 feet. Rail removed and not to be reset, shall be disassembled at each joint or splice.
  4. **End Treatment and Transition.** The rail and end treatment not to be reset shall be disassembled at each joint or splice. The concrete anchors for the end posts shall be removed and disposed of by the Contractor outside the Right of Way.
  5. **Miscellaneous Hardware.** All miscellaneous hardware from the removed guardrail shall be placed in containers at the stockpile site.
  6. **Anchors.** If the Engineer determines that the concrete end anchors and anchor rods do not interfere with other construction, they may be cut off one foot below ground level and the surface restored to match the surrounding area. When concrete anchors are removed, the holes shall be backfilled with approved material in 8-inch layers. Each layer shall be thoroughly tamped using a mechanical tamper. The removed concrete will be disposed of outside the Right of Way by the Contractor.
  7. **Disposal of Unsalvageable Materials.** All concrete posts, damaged wood or steel posts, damaged rail and hardware shall be disposed of by the Contractor outside the Right of Way.
- E. **Reset Cable Guardrail.** The Contractor shall modify the existing guardrail as shown on the Plans and Standard Drawings.

When the Plans call for resetting of 4-cable guardrail, the Contractor shall furnish and install new posts, hook bolt assemblies, turn buckle tie rods, bearing blocks, concrete anchors, and splicing materials as required for the new installation.

On wedge-type connections, one wire of the wire rope shall be crimped over the base of the wedge to hold it firmly in place.

The backfill shall be thoroughly tamped using a mechanical tamper.

- F. **Reset W-Beam Guardrail.** Guardrail used for Reset W-Beam Guardrail and the material for replacement of bent or damaged sections shall be obtained from salvage.

The connector used for attachment to the retrofit bridge rail shall be furnished and installed as shown in the Contract.

- G. **Reset Box Beam Guardrail.** Material for Reset Box Beam Guardrail and for replacement of bent or damaged sections shall be obtained from salvage unless otherwise directed.

- H. **Completion Requirements.** On projects where existing guardrail is to be removed and replaced or reinstalled, and the roadway will be open to traffic during construction, the guardrail installation shall be completed within 5 working days from the day the controlling item of work is sufficiently complete to allow guardrail installation to commence. Controlling items include, but are not limited to, structure, barrier, paving, and grading work. Prior to any guardrail removal, a written construction schedule for work in the guardrail area shall be developed by the Contractor and Subcontractors (if any), and approved by the Engineer. In no case shall work cease between controlling items of work for more than 4 working days. The Department reserves the right to suspend progressive estimate payments for failure to comply with these requirements.

- I. **Attenuating Crash Cushions:** The attenuating crash cushion shall be installed in the locations shown on the Plans. The attenuating crash cushion shall consist of energy-absorbing material surrounded by a framework of steel, panels, and a nose cover fabricated from plastic or other material with a yellow color. Also concrete slab and anchorage units. The unit shall be able to withstand the environment extremes in the state of North Dakota and operate as specified in this environment.

The units shall have been crash tested in accordance with NCHRP Report 350, Test Level 2 or 3, and approved by the FHWA in writing. The FHWA approval letter shall be provided to the Construction Office with the attenuating crash cushion shop drawings.

The nominal width of the system shall be as shown on the plans. The unit shall be installed in accordance with the manufacturer's recommendation. A Class AAE-3 reinforced concrete slab shall be constructed for each unit as recommended by the manufacturer. All anchorage requirements for the unit to concrete slab shall be installed in accordance with the manufacturer's recommendations. Transition panels shall be installed from the unit to the barrier end or transition as shown on the plans. The contractor shall furnish shop drawings for approval for the attenuating crash cushion. The shop drawings shall include manufacturer's specifications, erection instructions, maintenance instructions, and the FHWA approval letter.

#### **764.04 METHOD OF MEASUREMENT.**

- A. **Guardrail.** Guardrail will be measured by the linear foot of guardrail complete, in place, and accepted by the Engineer. The cost of furnishing and installing all posts,

anchors, end treatments, bridge connections, and other items necessary to complete the guardrail installation shall be included in the payment for guardrail. Costs of drilling, backfilling, and bituminous material will not be paid separately, but shall be included in the price bid for Guardrail.

Reflectorized plates will not be measured but shall be included in the bid items for installing or resetting guardrail.

- B. **Remove Guardrail and Posts.** Removing, salvaging, and stockpiling guardrail materials will be measured by the Linear Foot.
- C. **Reset Guardrail.** Measurement will be by the Linear Foot of reset guardrail complete and accepted by the Engineer.  
  
Cost of furnishing and installing the W-Beam Terminal Connector shall be measured and paid for by the Linear Foot of Reset W-Beam Guardrail.
- D. **Median Barrier.** Measurement will be by the Linear Foot of median barrier complete and accepted by the Engineer.
- E. **End Treatment and Transition.** Measurement will be by the individual item (each).
- F. **Vertical Panels.** Measurement will be by each vertical panel complete and in place.
- G. **W-Beam Guardrail End Terminal.** W-Beam Guardrail End Terminals will be measured by the unit for each unit installed and accepted by the Engineer.
- H. **Attenuating Crash Cushion.** Measurement will be by the number of complete units installed and accepted by the Engineer.

#### 764.05 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

<b>Pay Item</b>	<b>Pay Unit</b>
_____ Guardrail	Linear Foot
Remove _____ Guardrail and Posts	Linear Foot
Reset _____ Guardrail	Linear Foot
Median Barrier	Linear Foot
Box Beam End Treatment	Each
_____ End Treatment and Transition	Each
Reset _____ End Treatment and Transition	Each
Vertical Panels	Each
W-Beam Guardrail End Terminal	Each
Attenuating Crash Cushion	Each

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.